

Rhodora

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REED CLARK ROLLINS, Editor-in-Chief

ALBERT FREDERICK HILL
STUART KIMBALL HARRIS
RALPH CARLETON BEAN
RICHARD ALDEN HOWARD
CARROLL EMORY WOOD, JR.

} Associate Editors

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8 and 10 West King St., Lancaster, Pa.

Botanical Museum, Oxford St., Cambridge 38, Mass.

abortion only one and subglobose, or 2 and semiglobose, or rarely 3 with flattened sides. Summarizing this information then, one might expect to find usually one, or possibly up to three, seeds per fruit.

Since there seems to be as much variation in the literature as in the fruit, and more than three seeds per capsule are often found, it was thought necessary to make some actual counts in conjunction with a much broader study of the entire genus.

Collections of fruit from six species were made during the summer of 1954 and studied from the point of view of the number of mature seeds, the position of these seeds within the capsule and the number of locules present. The result of this analysis is presented here.

Each fruit was examined and the number of mature seeds and their position recorded. In Table 1, "top" and "bottom" refer to the ascending and descending ovules respectively. The fifteen position-combinations were determined from the abortive ovules more easily than from the mature ones since the former more nearly retain their original position after the great enlargement of the seeds. More combinations could be recognized if, e.g. with 3 and 4 seeds, it were determined whether one or both ovules mature within the same locule. This information was kept only for 2-seeded combinations—both seeds in the same or different locules. Also given in Table 1 is the number of fruits found with a particular combination and the percentage based on the total fruits examined for each species.

From three trees of *A. hippocastanum* L. growing on the University of Michigan Campus and from two trees along a highway in Franklin County, Ohio, a total of 107 fruits was collected and examined. Table 1 indicates that the 1-seeded fruit was the most common type and that the ratio of "top" to "bottom" was essentially 1:1. In the 2-seeded type the most frequent combination was the 1 — 1 diff., meaning one ascending and one descending seed but in different locules.

An analysis was made of 153 fruits of *A. glabra* Willd. which were collected from a small population in Washtenaw County, Michigan. The 1-seeded capsule was again found to be the most common (Table 1) and maturation of ovules occurred in essentially the same numbers for ascending and descending.

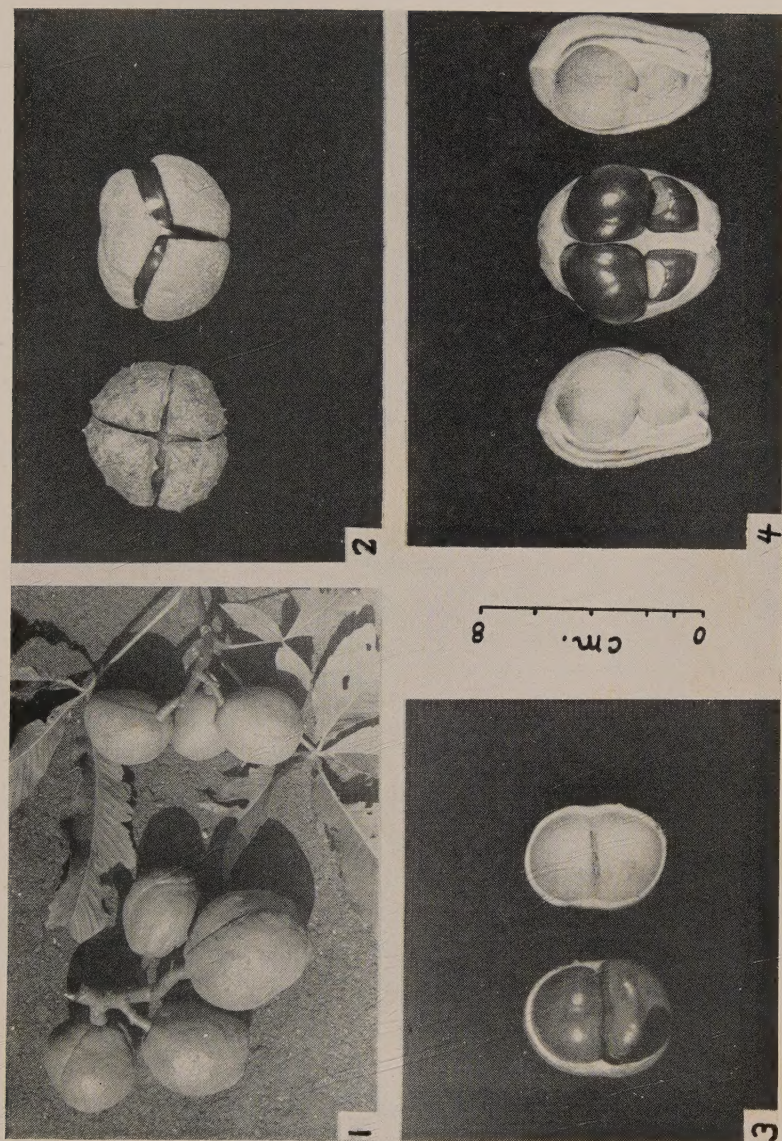


PLATE 1205. FIG. 1, Variation in size and shape of *Asculus octandra* fruit. FIG. 2, Anomalous 4-locular capsule (left) and typical 3-locular capsule (right) of *A. hippocastanum*. FIG. 3, Anomalous 2-locular, 2-seeded and bi-valved capsule of *A. sylvatica*. FIG. 4, Fruit of *A. octandra* showing suppression of lower two ovules. Scale applies only to Figures 2, 3 and 4.

Aside from percentages which differ between *A. hippocastanum* and *A. glabra*, the most obvious difference is the occurrence in *A. glabra* of fruit with four, five and six mature seeds. Only one fruit each of the 5- and 6-seeded type was found, but it is significant that this condition does occur, even though seemingly rare for the species as well as the entire genus.

Fifty five capsules of *A. octandra* Marsh., from a population in Haywood County, North Carolina, were studied. Over half were of the 1-seeded type, although 2-, 3- and 4-seeded forms were found in decreasing frequencies.

A total of 145 capsules of *A. sylvatica* Bartr. were examined from two populations, one from Clarke County, Georgia and the other introduced from Georgia and now growing at the University of Michigan Botanical Garden. Again there was a high percentage of 1-seeded fruits, but also relatively high percentages of 2- and 3-seeded forms were found.

A very small and probably clonal population of *A. parviflora* Walt. was visited in Early County, Georgia during June 1954. Mature fruits were not available, but a population sample of partially mature fruits was collected. Analysis of these showed only the one-seeded type. This lack of variation is of interest since the population is probably one clone which occupies an area of nearly 400 square feet and includes approximately 75 trees.

Sixteen capsules were kindly sent from a small population of what is tentatively considered *A. discolor* Pursh growing near Old Sutherland Springs, Wilson County, Texas. It was unusual to find no 1-seeded fruits among this collection. Over half were of the 2-seeded type and the rest 3- and 4-seeded.

Considering all six of these species together, percentages are given (Table 1) for the genus based upon the random samples totaling 504 capsules. The emphasis which previous authors have placed upon the 1-seeded type is not justified on the basis of these figures which show that this form is present in barely more than one half of the total. Over one quarter of all fruit was of the 2-seeded form and just under one eighth had three seeds. The most significant deviation from the literature is the nearly 4% of the total which contained four to six seeds.

Correction should be made of the error found in the literature regarding the interpretation of the number of locules present

in the mature fruit. Regardless of the number of seeds maturing, and the crushing of the locules by the excessive growth of the seeds, each of the locules remains at least partially distinct with its abortive ovules in their original position. The typical fruit then, is always 3-locular regardless of whether 1-seeded or 2- to 6-seeded.

Exceptions to this 3-locular condition were found in two of the species. Four-carpellate, 4-locular and in maturity 4-valved fruits of *A. hippocastanum* were found among the collections (Fig. 2). Also 2-locular and 2-valved fruits of *A. sylvatica* were found (Fig. 3). Of the 107 capsules of *A. hippocastanum* examined, thirteen of them, or 12%, were 4-locular. The majority of these were of the 1-seeded type, only a few having 2 seeds. Each of the four locules was distinct at maturity and each contained the expected two ovules. Only two capsules of *A. sylvatica* out of the 145 examined were 2-locular. One of these was 1-seeded and the other 2-seeded. The expected total of four ovules was present in both cases. The anomalous condition of 2 or 4 locules is rare, or at least infrequent in *A. hippocastanum*. Just what evolutionary significance these conditions have, if any, is not yet known.

At the outset of this study, the question arose as to whether only the ascending or descending ovules matured, or if both, in what proportions. The answer is shown in Table 1. A 1:1 ratio was found in the 1-seeded forms. In the 2-seeded and 3-seeded capsules only slightly more of the ascending ovules matured. These ratios show that the position of the maturing ovule in respect to ascending or descending is entirely random, and abortion is not due to a morphological degeneration of a portion of the ovary or placenta.

The cause of abortion in the majority of ovules is not known. According to Gray (1849) and Rendle (1925) the pressure from the maturing ovules is the important factor. If this were true, one would expect to find some degree of enlargement in all six ovules. Fig. 4 illustrated one of the few cases seen where pressure was effective in retarding the growth of ovules. In this case the lower two ovules did enlarge greatly until presumably stopped by pressure from the top. The smaller two were not true abortives since they expanded to full size after the capsule was opened. In practically every other case, the abortive

ovules were 1-4 mm. in diameter—the size being nearly constant within a single capsule. Even when one mature seed was found in a locule, the second and abortive ovule in that locule showed no signs of being crowded. The “pressure” theory then, does not seem to be the answer in the majority of cases.

Incomplete fertilization could possibly be the determining factor. If this were true, then the unfertilized ovules would not ordinarily enlarge, which is found to be the case in these capsules. This incomplete fertilization could arise because of an incomplete pollination, or more probably caused by some morphological, physiological or genetic sterility factor. The answer to this question involves a major research problem in itself.

The phylogenetic significance of seed number in the genus *Aesculus* is not completely understood at this point. If one extreme in number (1-seeded or 6-seeded) is more primitive than the other in terms of evolution of the family, genus or species, the interpretation may be made only after a more complete study of the related taxa within the Sapindales.

DEPARTMENT OF BOTANY, UNIVERSITY OF MICHIGAN.

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A REVISION OF THE NORTH AMERICAN
GENUS *SABATIA* (GENTIANACEAE)

ROBERT L. WILBUR

(Continued from page 33)

C. Subsection *CAMPESTRES* Blake, *RHODORA* 17: 56. 1915.*Neurola* Raf., New Fl. 4: 92. 1838.

Annuals, branches typically alternate, at least above. Basal rosette never present. Leaves either thin and membranous or thick and succulent, margins not scarious. Calyx-tube conspicuously ribbed or costate by the prominent development of the fused lateral traces and bearing a thin membranous wing. TYPE SPECIES: *Sabatia campestris* Nutt.

This subsection contains but two species which are obviously closely related to one another and which are strongly and uniquely distinguished from the other groups by the prominently developed calycine costae. In addition, the typically alternate branching pattern sets this small species-group apart from subsection *Angulares*, to which it is probably most closely related. Also, the *Angulares* possess a very well-developed basal rosette at some stage in their life-cycle although it is not always persistent at time of flowering; the *Campestres* are never rosulate. An additional indication, besides the aspect of the plants, the texture of the leaves, and perhaps the habit, of the relationship of this group to the opposite-branched *Angulares* is the pronounced quadrate stems in the species of both subsections (at least above) which are margined along the angles by a thin, hyaline membrane.

The distribution of the *Campestres* is almost entirely west of the Mississippi River where the subsection occupies an extensive area. *S. campestris* accounts for the bulk of the subsectional range. *Sabatia arenicola* is very obviously related to *S. campestris* and is believed to have been derived from that species or from its precursor. *S. arenicola* is at present known only from the Quaternary littoral deposits along the beaches from Louisiana to southern Tamaulipas.

KEY TO THE SPECIES OF SUBSECTION *CAMPESTRES*

- A. Leaves and calycine lobes thin and membranous, neither succulent nor heavily cutinized; leaves broadest near the base, usually strongly clasping the stem, the midvein at least prominently elevated beneath; calyx-lobes usually 2-6 times longer than the calyx-tube, generally 4-8 times longer than broad; corolla-lobes typically equaling or exceeding the calyx-lobes,

usually longer than 1 cm. and wider than 7 mm.; stigmatic lobes over 5 mm. long; anthers longer than 2 mm.; widespread in prairies and fields from Texas to Mississippi and north to Illinois and Kansas.

6. *S. campestris*.

- A. Leaves and calycine lobes thick and succulent, heavily cutinized; leaves broadest above the base, tapering somewhat to the sessile, nonclasping base, venation obscure and flush with the surface; calyx-lobes usually less than twice the length of the calyx-tube, generally less than 4 times as long as broad; corolla-lobes usually equaled or exceeded by the calyx-lobes, the corolla-lobes usually less than 1 cm. long and narrower than 7 mm.; stigmatic lobes less than 5 mm. long; anthers shorter than 2 mm.; restricted to the strand and dunes from Louisiana southward into Mexico.

7. *S. arenicola*.

6. *Sabatia campestris* Nutt., Trans. Am. Phil. Soc. n. s. 5: 197. 1835. *S. nervosa* Raf., New Fl. 4: 92. 1838. *Neurola arkanzica* Raf., l. c., an alternate name. *Sabbatia formosa* Buckl., Proc. Acad. Phila. 1862: 7. 1863. *S. campestris* f. *albiflora* Moore, Proc. Ark. Acad. Sci. 1: 26. 1941.

Erect annual (6-)15-30(-40) cm. high; stems 1-3 mm. wide, strongly quadrate throughout, the corners winged by a thin hyaline membrane, 0.1-0.2 mm. high. Branches usually few or absent from the lower half of the stem, but when present sometimes opposite, typically alternate throughout, usually widely divergent, often forming angles of 60-90 degrees with stem, giving plant a loose, strikingly divaricate or even geniculate aspect or, more rarely, forming a fuller, more compact, corymbiform crown, or in unfavorable situations sometimes unbranched. Root system of few to several fibrous roots or of a slender, wiry tap-root usually 5-10 cm. long bearing several slender laterals. Leaves thin, membranous, neither succulent nor heavily cutinized, primary venation apparent even in living material and at least the midrib noticeably elevated on the lower surface, conspicuously 3-5-nerved in dried specimens. Lowermost leaves rarely conspicuously different in either texture or shape from those at the middle or upper nodes, except usually somewhat smaller in size, rarely persistent at anthesis; or very rarely quite different in being broadly elliptic to oblong, tapering to the base and up to 8 cm. long, above narrowly lanceolate to broadly so, or ovate-lanceolate, rarely somewhat oblong or even ovate, typically broadest at or very near the base, generally broadly clasping, usually those at the lower nodes obtuse while the upper are acute, the tip callose-mucronulate, (0.8-)1.5-3.0(-4.0) cm. long, (0.3-)0.8-1.5(-2.0) cm. wide, usually about (1-)1.5-2(-3) times as long as broad. Internodes (1-)2-5(-10) cm. long, usually about 1.5-4 times the length of the leaves. Inflorescence usually of loosely-arranged, divergent, reduced, 1-2-flowered cymes forming a more or less open corymbose cluster. Peduncles (or pedicels) wiry, rigid, pentagonal, (1-)2-5(-10) cm. long, bearing fine hyaline membranous wings at the angles. Calyx-tube broadly campanulate, usually about 1-1.5 times as long as broad, (3-)4-6(-8) mm. long; strongly pentagonal with 5 thin, membranous costae or ribs elevated about 1 mm. with fine hyaline margins. The intercostal tube very thin, membranous,

translucent, appearing green due to ovary within. Calyx-lobes thin, membranous, not heavily cutinized, strongly spreading at anthesis, (1.5-)2-4(-6) times longer than the tube, acute, apiculate, linear, (0.4-)1.0-2.2(-3.2) cm. long, usually 4-8 times longer than broad, strongly resembling the leaves in texture. Corolla-tube usually 1-2 mm. longer than the calyx-tube, colorless except for the extension of the yellow "star" patches in the uppermost portion. Corolla-lobes typically equaling or exceeding the calyx-lobes, occasionally shorter, ascendent to rather strongly spreading, oblong, elliptical, or most commonly broadly obovate or spatulate, acute to obtuse, (1.0-)1.3-2.0(-2.3) cm. long, (0.4-)0.6-1.3 (-1.5) cm. wide, rose to pale pink or rarely white with a 3-4 mm. by 1-1.5 mm. greenish-yellow patch at the base of the lobe, bordered by a white area and sometimes by a more densely roseate region. Anthers bright yellow, narrowly linear, 2.5-5(-6) mm. long; filaments white to pale yellow, slender, 3-6 mm. long. Style slender, white to pale yellowish, 3-4 mm. long; stigmatic branches greenish at first, turning yellow at maturity, 5-8 mm. long. Capsules 5-9 mm. long, either equaling and included within the calyx-tube or exerted about 2-4 mm. TYPE LOCALITY: "in the open prairies of Arkansas and Red River." Type: Nuttall's collection, presumably in the Herbarium of the Philadelphia Academy of Science, but not seen. DISTRIBUTION: Fields and prairies from Illinois to Kansas south throughout most of the eastern half of Texas and eastward to Mississippi. Very rarely introduced farther east. Map 6.

This species is easily recognized by its prominently ribbed calyx-tube together with its thin, membranous leaves.

Nuttall's type, or authentic material known to have been in his possession when the original description was made, has not been seen by me but his diagnosis is so ample as to leave no doubt as to the plant he had at hand. As yet but four species of the genus are known from Arkansas and of these Nuttall's excellent description fits but one. The original collection is stated to have been made "in the open prairies of Arkansas and Red River."

If one were to accept the date of publication that appeared with the works of Nuttall and Rafinesque describing this species, a different conclusion than that adopted here would be reached as to which name has priority. Nuttall's "Collections towards a Flora of the Territory of Arkansas" appeared in Vol. 5 of the "Transactions of the American Philosophical Society." It has therefore been dated as 1837, the year that that volume was apparently completed. Foster (*RHODORA* 46: 156-157. 1944.) has pointed out that that date is certainly later than the publication and distribution of Nuttall's contribution.

W. J. Hooker was familiar with Nuttall's account and cited it and descriptions provided in it on several occasions. The original diagnosis of *S. campestris* was quoted by Hooker (Comp. Bot. Mag. 1: 171. 1836.) and its place of publication cited to the page. Since Sprague (Kew Bull. 1933: 362-364.) has provided very precise dates for the publication of the various parts of Hooker's "Companion to the Botanical Magazine," it is certain that the whole of Nuttall's Flora, and not just the first twenty-one pages, as implied by Foster, was published and had reached England some time prior to the publication of Vol. 1, No. 6, of the Companion, which appeared January 1, 1836. The four parts or volumes of Rafinesque's New Flora were issued, not in 1836 as stated on the title page, but at various dates between very late in 1836 and late in 1838. This has been demonstrated rather conclusively by Barnhart (Torreya 7: 177-181. 1907.). The names of *Sabatia* appeared in the part which appeared in 1838.

The Rafinesquian names here considered as synonymous with *S. campestris* were all published in one paragraph and were intended for the same entity. His account is quoted in full as it seems the surest way to prove the identity of the plant described by him and also to explain his peculiar nomenclature.

975. *Sabbatia* ? *nervosa* Raf. ramose pauciflore, branches aneups, leaves ovate lanceolate trinerve acute, peduncles axil. and terminal, calix base campanulate 5 gone, segments linear elongate nervose, corolla as long as calix, segments broad obovate, trinerve at base—anonymous sp. of Nuttall, which deserves perhaps to be a genus *Neurola* Raf. by calix 5 gone corolla nerved, stamens rolled up but not twisted, style declinate and with linear stigmas as in *Sabbatia*. From Arkansas, 8 inches high, leaves small remote semi-uncial, flowers large over uncial incarnate ? *Neurola arkanzica* will be a better name.

This description, which alone is rather convincing, coupled with the information that the specimen was one of Nuttall's collections from Arkansas leaves no doubt as to the identity of the plant. Nuttall found but two species on that journey, *S. campestris* and the well-known *S. angularis*. Rafinesque (Aut. Bot. p. 55. 1840.) was still uncertain as to the proper rank to bestow upon this species for he referred to it as "*Sabbatia nervosa* or *Neurola arkanzica* . . . fine subg. perhaps a Genus . . ."

The final proposition of specific rank made for this species was that of Buckley. The specimen upon which this was

based has not been seen by me but again the description is such that determination is certain. The original publication reports it to have been collected in Llano Co., Texas, from whence numerous specimens of *S. campestris* have been examined. That is the only species of the genus known from Central Texas. Buckley's proposal was promptly relegated to synonymy by Gray (Proc. Acad. Nat. Sci. Phil. 1862: 166. 1863.) whose regret as to the "hundred worse than useless synonyms" published with *S. formosa*, especially after the caustic criticism strongly reminiscent of an even later Fisher Professor of Natural History, was doubtless shared by Buckley.

Merrill (RHODORA 50: 127. 1948.) equates *S. concinna* Wood with *S. campestris* rather than with *S. brachiata* to which Gray long before had reduced it and to which Wood himself later considered it synonymous. The evidence that it is anything but *S. brachiata* is not convincing and the name is discussed more fully under that species.

REPRESENTATIVE SPECIMENS:—ILLINOIS: DuPage Co., Hinsdale, *Smith* 497 (F). MISSISSIPPI: Covington Co., about 13 mi. nw. of Hattiesburg, *Webster & Wilbur* 3359 (MICH). MISSOURI: Christian Co., 2 mi. s. of Saundards, *Steyermark* 23232 (F, MO, NY, TENN, WIS); Jasper Co., near Asbury, *Palmer* 34661 (MO, NY). ARKANSAS: Benton Co., 9 mi. ne. of Springdale, *Moore* 350339 TYPE of *S. campestris* f. *albiflora* Moore (TARK); Bradley Co., Warren, *Demaree* 19268 (MO, NY, OKLA). LOUISIANA: Calcasieu Parish, vicinity of Lake Charles, *Allison* 279 (NY, US); Winn Parish, 10 mi. w. of Winnfield, *Webster & Wilbur* 3261 (MICH). KANSAS: Bourbon Co., 4 mi. w. of Fort Scott, *Horr* E165 (DUKE, FLAS, NCS, OKL, OKLA, PENN, SMU, US); Cherokee Co., Baxter Springs, *Oyster* 5445 (F, MO, NY); Montgomery Co., 5 mi. ne. of Caney, *Rydborg & Imler* 408 (KSC, MO, NY, US). OKLAHOMA: Cleveland Co., Norman, *Demaree* 13112 (GH, MO, NY, OKL, US); Comanche Co., near Cache, *Stevens* 1328 (GH, MO, NY, OKL, OKLA, US); Creek Co., 7 mi. n. of Sapulpa, *Ownbey* 1606 (GH, MICH, MO, NY, OKL, PENN, TEX, US); Johnston Co., near Mannsville, *Griffith* 3474 (GH, MO, NY). TEXAS: Brazoria Co., Columbia, *Bush* 76 (GH, MO, NY, US); Calhoun Co., Port Lavaca, *Tharp*, 22 May 1930 (DUKE, KSC, MO, MT, OKLA, TAES, TEX, WVA); Frio Co., near Moore, *Palmer* 33868 (GH, MO, NY, US); Harris Co., Houston, *Hall* 508 (BRU, F, GH, NY); Llano Co., Enchanted Rock, *Tharp*, 11 June 1930 (GH, MO, NY, SMU, TAES); Parker Co., Weatherford, *Tracy* 8045 (CU, F, GH, MO, NY, TEX, US); Rockwall Co., ca. 30 mi. e. of Dallas, *Webster & Wilbur* 2960 (MICH); Travis Co., Austin, *Tharp*, 16 May 1939 (MICH, MO, NA, NY, SMU, TEX).

7. *Sabatia arenicola* Greenm., Proc. Am. Acad. 34: 569. 1899. *S. carnos* Small, Fl. SE. U. S. 927. 1903.

Erect annual (3-)10-20(-32 or up to 45 in greenhouse-grown plants) cm. high; stems rigid, 1-3 mm. in diameter, succulent when young but becoming less so with maturity, more or less terete in the lowermost internodes but soon becoming strongly quadrate above and the corners

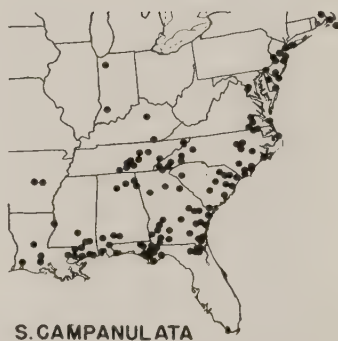
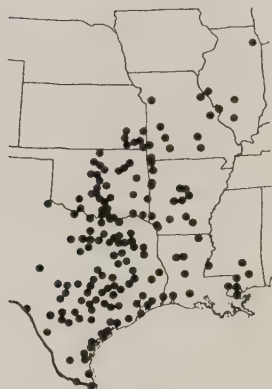
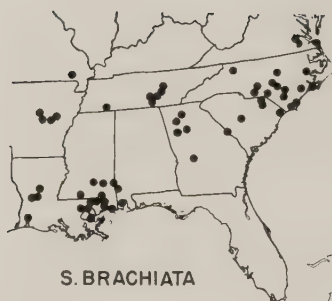
winged by a fine, hyaline membrane about 0.1-0.3 mm. high that is barely discernable in dried material. Branches most commonly arising from near the base and then often opposite but becoming alternate above, or in more loosely developed plants absent from the lower half of the plant and alternate throughout, strongly ascendent or at first widely divergent (up to 60 degrees) and, in plants grown under the normal highly exposed environmental conditions, typically presenting an almost globose form or a compact corymbiform to convex crown. Root-system most commonly a strongly developed tap-root or almost as commonly with several almost equally developed fibrous roots; these 4-20 cm. long and bearing few to several slender laterals. Leaves thick, widely spreading, strikingly succulent, shiny, heavily cutinized, venation almost completely obscured in living material, not at all elevated on either surface, appearing 3-5 nerved in dried specimens, the lowermost narrowly spatulate to somewhat elliptic, strongly tapering to the almost petiolate base, above becoming elliptical to ovate-lanceolate or rarely somewhat oblong, usually broadest one-fourth to one-third the length from the base or even near the middle, and somewhat tapering to the sessile, non-clasping base, (0.7-)1.2-1.8(-2.7) cm. long, (2.0-)5.0-8.0 (-13.0) mm. wide, usually about 1.5-4 times as long as broad, obtuse to acute with a minute, non-chlorophyllous callosity forming a mucronulate tip. Internodes (0.3-)1.0-2.0(-8.0) cm. long, usually 0.5-2 times the length of the leaves but in more loosely developed plants not uncommonly up to 4 or more times as long as the leaves. Inflorescence of corymbosely to pyramidally arranged cymules compactly clustered or borne loosely in plants grown under less rigorously exposed conditions. Cymules 1-2-flowered. Pedicels often somewhat succulent, rigid, pentagonal, bearing 5 fine, hyaline, membranous wings, 0.5-3(-7) cm. long. Calyx-tube broadly campanulate to urceolate, usually about twice as long as broad, (0.3-)1.0-2.0(-8.0) mm. long, becoming broadly turbinate in fruit, strongly pentagonal due to thick, somewhat succulent, costae or ribs about 0.5-0.7 mm. high, the internal portion of which is chlorophyllous, the outer finely hyaline margined. Intercostal tube very thinly membranous, colorless but translucent, thus appearing green due to the ovary within. Calyx-lobes thick, succulent, heavily cutinized, erect in bud but becoming strongly spreading at anthesis, (0.5-)1-1.5(-3) times longer than the tube, (0.3-)0.5-1.2(-2.0) cm. long, oblong to most commonly linear-lanceolate, usually about 3 times as long as broad, acute, minutely hyalinely callose-tipped, becoming prominently nerved when dried, in general very similar to leaves in texture. Corolla-tube exceeding calyx-tube as well as the ovary by about 1-2 mm., lower portion colorless, the upper colored by extension of the yellow patches at lobal bases. Corolla-lobes more or less equaling or somewhat shorter than the calyx-lobes, or rarely longer, ascendent to strongly spreading, broadly spatulate, obovate, or oblong, obtuse, (0.5-)0.7-1.0(-1.3) cm. long, 3-7.5 mm. wide, deeply roseate or pure white, both forms with a 2-3 mm. long, 1.5 mm. wide basal, oblong, yellow patch, which in roseate forms is often bordered by deeper shade of red. Anthers bright-yellow, oblong,

1.5–2 mm. long; filaments white to pale-yellow, slender, 2–4 mm. long. Style slender, colorless to pale greenish-yellow, 2–3.5 mm. long, stigmatic branches green to greenish-yellow, 2.5–4 mm. long. Capsule 5–9 mm. long, equaling and included within the calyx-tube or exerted by 1–3 mm. TYPE LOCALITY: "on damp sands of seacoast near Tampico, State of Tamaulipas, Mexico." TYPE: *Pringle 6808* (GH!). DISTRIBUTION: Beaches and dunes from Louisiana southward to at least the southern part of the State of Tamaulipas, Mexico. Map 7.

The pronounced succulence of this species is perhaps its most striking characteristic and that by which it is most readily distinguished from the closely related but perfectly distinct *S. campestris*.

Many of the differences noted between the two species of subsection *Campestres* are such that one might expect them to be merely response of a highly plastic organism to an environmental extreme. Succulence and diminution of the various organs and structures and the assumption of an almost globose, compact form are features that logically would be expected among the littoral members of a species of wide environmental variation. *Sabatia arenicola*, found along the strand and dunes from Louisiana to at least Tampico in Mexico, possesses such characteristics and accordingly suspicion is raised as to its status.

The few specimens of *S. campestris* observed in the field in almost similar situations, although stunted or dwarfed, failed to show the peculiarities characteristic of the littoral species. Furthermore, herbarium specimens of plants that were undoubtedly *S. campestris*, as indicated by their morphological characters, were collected, according to their accompanying labels, from what was approximately the environment of *S. arenicola*. In addition, numerous plants of *S. arenicola* grown in the greenhouse from seeds collected at various stations along the Texas coast retained the pronounced succulent nature so characteristic of the littoral species. The greenhouse-grown plants were larger, more elongate, and much more diffuse than the majority of specimens of *S. arenicola* seen by me either in the field or in the herbarium but are approached to some extent by those growing in nature in the more sheltered areas. The principal distinguishing characters mentioned in the key remain constant and the plants of the two species grown side by side are readily separable.



Maps 5-8. Map 5, upper left; map 6, upper right; map 7, lower left; map 8, lower right.

Two specimens were annotated by Small as *S. carnosa*. These are the only representatives of the littoral species that were available to him at New York prior to 1903 when his *Flora* was published. None of the specimens on either of the sheets is as much as 3 dm. tall, the maximum height mentioned in the original description. However, it is likely that these were the only examples seen by him before publication; they were certainly the only two annotated by him as that species and one of them should be chosen as the type of the name. The only collection of the two that matches the statement "often branched at the base" is that of A. Schott taken on the beach at Brazos

Santiago near the mouth of the Rio Grande on the expedition led by Major Emory to survey the Mexican boundary. The other specimen annotated as *S. carnosa* by Small is one of Drummond's but no other information, other than that it was from Texas, is presented on the accompanying label. However, the great similarity in aspect and in state of preservation strongly suggests that it is a duplicate of these specimens seen at both the Gray Herbarium and Kew which bear Drummond's collection number "59" and which came from the "Rio Brassos" (Rio Brazos) Texas. The New York specimen may well be taken as the lectotype of *S. carnosa*. These specimens, the basis of Small's *S. carnosa*, can in no way be distinguished from Greenman's *S. arenicola* which has four years priority.

This species and *S. campestris* are usually readily separable if the specimens are adequate. A few collections have been seen, however, that indicate that hybridization may be taking place between them in the region where they come into contact. Careful observation in the field should do much toward settling this suspicion.

REPRESENTATIVE SPECIMENS:—LOUISIANA: Jefferson Parish, Grand Isle, *Cangemi & Andrus*, 13 June 1931 (NY); Terrebonne Parish, Timbalier Island, *Tharp*, 29 July 1929 (MO, TEX). TEXAS: Aransas Co., n. of Rockport, *Whitehouse 18232* (SMU); Brazoria Co., Rio Brazos, *Drummond 59* (GH, K, NY); Calhoun Co., beach near Port O'Connor, *Webster & Wilbur 3134* (MICH); Cameron Co., beach at Brazos Santiago, *Schott 27* (F, NY), about 3 mi. w. of Boca Chica, *Lundell 8635* (GH, MICH, NY, SMU); Galveston Co., beach on Galveston Island, *Webster & Wilbur 3153* (MICH); Harris Co., Morgan's Point, *Palmer 11966* (MO, US); Kennedy Co., El Toro Island, *Tharp 49218* (TEX); Kleberg Co., Kingsville, *Sinclair*, 1940 (TEX); Matagorda Co., beach beyond Sargent, *Webster & Wilbur 3152* (MICH); Nueces Co., north end of Padre Island, *Webster & Wilbur 3092* (MICH); San Patricio Co., 10 mi. s. of Aransas Pass, *Whitehouse 18213* (SMU).

MEXICO: TAMAULIPAS: Washington Beach, *Runyon 461* (GH, NY, US); San Jose, *LaSueur 349* (TEX); vicinity of LaBarra, 8 km. e. of Tampico, *Palmer 297* (F, GH, US); Tampico, *Pringle 6808* (BRU, F, GH, NY, UC, US).

D. Subsection CAMPANULATAE Blake, RHODORA 17: 56. 1915.

Annuals or perennials with either slender tap-root, several fibrous roots, or an erect, branched, perennating caudex. Branches typically alternate. Corolla 5-parted, rose, pink, or white. Calyx smooth or finely ribbed, not wing-costate. TYPE SPECIES: *Sabatia campanulata* (L.) Torr.

The species forming this subsection are not of uniform habit of growth as three of the species are annuals, while one, the type, is a perennial

with a subterranean system unique in the genus. This is the only species-group showing diversity in life-form. The branching pattern in this group is typically alternate, but this character is highly variable, as it is throughout most of the genus. This subsection is not set off by one strong characteristic or even by a series of lesser ones. Segregation of the annuals, leaving *S. campanulata* to form a monotypic subsection characterized by its shortly branched, erect, caespitose caudices, would result in two subsections, each certainly more homogeneous than the present one. For the moment at least, I am hesitant about erecting additional subgeneric units as their utility is defeated when they become so numerous as to be composed of only one or two species. The genus is already, for one so small, burdened with a large number of subgeneric units.

KEY TO THE SPECIES OF SUBSECTION CAMPANULATAE

- A. Caespitose perennial from branched, erect caudex; calyx-lobes usually more or less equaling the corolla in length. 8. *S. campanulata*.
- A. Annuals with either a tap-root or several fibrous roots; calyx-lobes usually less than three-fourths the length of the corolla.
 - B. Calyx lobes linear to almost filiform, usually more than 8 mm. long; corolla usually roseate, rarely white; style 2 mm. or more in length; branches usually not numerous, mostly restricted to the upper half of the stem; nodes along the main axis not numerous, usually less than 15; root-system typically of several, almost equal, fibrous roots.
 - C. Leaves drying thin and smooth, the uppermost equaling or exceeding the stem in diameter; corolla-lobes usually less than 1.5 cm. long; calyx-tube usually turbinate or narrowly campanulate; known from Mexico, Cuba, the Bahamas, Florida west to Louisiana and north to southern Massachusetts. 9. *S. stellaris*.
 - C. Leaves drying thick and very noticeably rugose; above typically less than the stem in diameter; corolla-lobes usually longer than 1.5 cm.; calyx-tube usually broadly campanulate; known only from Cuba and peninsular Florida. 10. *S. grandiflora*.
 - B. Calyx-lobes setaceous or subulate, less than 8 mm. long; corolla white; style 1 mm. long or less; branches usually numerous and typically arising from throughout the length of the stem; nodes very numerous and typically more than 20 along the main axis; root-system of one prominently developed, wiry tap-root with several slender laterals.
 - 11. *S. brevifolia*.

8. ***Sabatia campanulata*** (L.) Torr., Fl. N. & Mid. U. S. 217. 1824. *Chironia campanulata* L., Sp. Pl. 1: 190. 1753. *C. gracilis* Michx., Fl. Bor. Am. 1: 146. 1803. *C. campanulata* β *gracilis* (Michx.) Pers., Syn. Pl. 1: 282. 1805. *Sabbatia gracilis* (Michx.) Salisb., Parad. Lond. t. 32. 1806. *S. campanulata* f. *albina* Fern., RHODORA 18: 151. 1916. *S. Tracyi* Gandoger, Bull. Soc. Bot. Fr. 65: 61. 1918. *S. campanulata* var. *gracilis* (Michx.) Fern., RHODORA 39: 444. 1937.

Caespitose perennial from an erect, short, much-branched, underground caudex 1-4 cm. long. Stems few to numerous, erect, (15-)30-60(-90) cm. high, 1-3 mm. in diameter, terete but often strongly ridge-angled

from fine elevated internodal lines, becoming hollow below. Branches typically alternate throughout, or occasionally those at lower nodes opposite, rarely opposite even above; usually restricted to the upper half of the stem but occasionally arising from throughout the length, strongly divergent forming an angle with the stem of 50–80 degrees or, especially in the northern portion of its range, strongly ascendent forming angle of about 20–40 degrees; few to numerous, slender, bearing but few nodes (more common in the northern portion of the range) or several. Root-system of few to many, slender, but apparently succulent, roots descending from the caudex, about 5–10 cm. long and 1 mm. thick bearing few to several very slender, fibrous laterals. Leaves ascendent to very commonly (especially the upper) strongly spreading, midvein noticeably elevated beneath, venation otherwise obscure, margins somewhat thickened and slightly revolute, drying thick, somewhat chartaceous, smooth or slightly rugose, obtuse to acute, broadly sessile or somewhat tapering in broader leaves to the base, the lowermost rarely ovate; the lower cauline (1–)1.5–3(–4) cm. long, (1–)2–7(–12) mm. wide, usually 5–12 times as long as broad, narrowly lanceolate, oblong, or linear gradually reduced above to very narrowly linear or even filiform; those of the branches narrowly linear to filiform. Internodes usually 1–2 times the length of the leaves. Flowers apparently solitary, borne on alternate, or rarely opposite, ascendent to widely divergent, slender branches bearing 1 to several nodes, or in more obvious cymules which are often reduced. Pedicels (2–)4–7(–9) cm. long, slender, wiry, slightly angled. Calyx-tube shallowly turbinate or more rarely somewhat campanulate, smooth or nearly so, not conspicuously nerved, scarious, usually about as broad as long, (1–)1.5–2.5(–3) mm. long. Calyx-lobes linear to very narrowly so or very commonly acicular or setaceous, erect to more commonly widely spreading, (6–)7–17(–23) mm. long, typically less than 0.5 mm. wide but occasionally as wide as 1 or even 2 mm., usually 5–15 times as long as the calyx-tube, generally nearly equaling the corolla in length, or but several millimeters shorter, rarely exceeding it. Corolla-tube cylindrical, about 2–3 times as long as the calyx-tube or exceeding it about 2–3 mm., colorless to white or pale greenish-yellow, (2–)3–5(–6) mm. long. Corolla-lobes wide-spreading, oblanceolate, oblong, or elliptic, acute to obtuse, (0.6–)0.9–1.8(–2.4) cm. long, (3–)4–7(–9) mm. wide, usually about 2–4 times as long as wide, rose, pink, or rarely white with an usually unlobed yellow area at base of lobe 2–3 mm. long, often bordered by a dull red irregular line. Anthers slender, bright yellow, (2–)3–4(–5) mm. long; filaments pale yellow, slender, 2–4 mm. long, usually shorter than the anthers. Style 2–5 mm. long, usually shorter than its branches, green to greenish-yellow; stigmatic lobes 3–7 mm. long, pale-green turning yellowish (with pollen?) at maturity. Ovary pale-green, slightly exserted from the corolla-tube. Capsule cylindrical, 5–7 mm. long, 2.5–4 mm. in diameter, usually 1.5–2 times as long as wide. TYPE LOCALITY: "in Canada." This plant is not known from farther north than Massachusetts. TYPE: *Kalm* (Photograph of the

Type in the Linnaean Herbarium seen in the collection of the Gray Herbarium). DISTRIBUTION: Peaty bogs and savannas along the Coastal Plain from Massachusetts south to northern Florida and westward to Louisiana and Arkansas; also found in the southern Appalachians and locally in Kentucky and Illinois. Map 8.

Fernald recognized two populations within this species. The supposed differences as defined by him are presented below.

<i>campanulata</i>	<i>gracilis</i>
Primary cauline leaves oblong-linear to lanceolate.	Lower cauline leaves linear, the upper ones very narrowly so.
Pedicels naked or only slightly bracted.	Pedicels mostly leafy-bracted.
The linear calyx-segments (except in small secondary flowers) 1-2 cm. long.	The linear-acicular calyx-segments 6-14 mm. long.
The corolla-segments 1-1.7 cm. long.	The corolla-segments 6-14 mm. long.
Branches erect or strongly ascendent.	Branches more divergent.
Upland and Piedmont region, Ga., and Ala., n. to Va., and Ind., and on or near Coastal Plain to se. Mass.	On the Coastal Plain from Florida to Louisiana and se. Va.

Many of the specimens studied could be assigned to one or the other group with a fair degree of assurance by applying these criteria. Yet there are a number of puzzling collections which aroused a strong suspicion as to one's ability to determine "correctly" a large series of specimens if one were unaware of their geographic origin. For example, Deam (1940) considered the material from southwestern Indiana to be a representative of the typically Coastal Plain population while Fernald (1950) mentioned Indiana only in the range of the *campanulata*-group.

Fernald (RHODORA 34: 27. 1932.) originally had considered the plants found along the southern Coastal Plain to be "a rather well defined species" although admitting that "... it may be better to treat it as a southern Coastal Plain variety ...". After encountering specimens in southeastern Virginia that possessed some of the supposed distinguishing characteristics of both varieties, Fernald (Rhodora 39: 444. 1937.) concluded that "... *S. gracilis* should be treated as a geographical variety." Those intermediate specimens combined the presumably characteristic narrow leaves and calyx-segments of the southern Coastal Plain population with the longer lobes of both calyx and corolla of the more northern collections. Since numerous

large-flowered specimens had been observed throughout the supposed range of the *gracilis*-population, the several hundred available measurements were tallied for comparison and are presented below. The specimens from southeastern Virginia which Fernald considered atypical as they showed features of both populations were not included.

mm.	LENGTH OF CALYX-LOBES		LENGTH OF COROLLA-LOBES	
	No. of lobes <i>gracilis</i> -range	No. of lobes <i>campanulata</i> -range	No. of lobes <i>gracilis</i> -range	No. of lobes <i>campanulata</i> -range
6	6	0	1	0
7	23	5	4	0
8	30	6	4	1
9	42	18	16	7
10	40	22	34	16
11	50	31	44	38
12	60	42	63	38
13	45	36	52	43
14	45	20	36	38
15	27	19	32	19
16	19	11	17	7
17	10	19	15	0
18	7	9	10	0
19	1	5	4	2
20	4	2	2	0
21	2	1	0	1
22	0	1	0	0
23	0	1	0	0
24	0	0	0	1

These hundreds of measurements indicate that, although the smallest flowers were found on the specimens from the *gracilis*-range and the largest from the range of the more northerly population, no reliance can be placed upon the length of either the calyx- or corolla-segments as a distinguishing characteristic between the two supposed varieties. These measurements show that the range of flower-size of the plants from the Coastal Plain is considerably greater than that known to Fernald and for diagnostic purposes the range of the length of the lobes of either floral series is so broadly overlapping as to be unworkable.

Nor am I able to detect any consistent differences in the shape of the calyx-lobes between those specimens of the Coastal Plain south of Virginia and those from the Appalachian region and the Coastal Plain north of Virginia. Numerous specimens from Florida and the other states of the supposed range of *gracilis* have linear calyx-lobes presumably characteristic of the northern variety.

By "pedicels" Fernald apparently meant lateral branches bearing flowers. These branches in the Massachusetts material, with which Fernald had field experience, are typically short and rather strongly ascendent and their one or two nodes bear bracts that are foliose in comparison to the narrowly linear to even filiform bracts of the typical southern coastal material. A tendency for opposite branching in the upper part of the stem is also more pronounced, especially in more robust specimens, and then the unreduced cymose pattern of inflorescence is somewhat more apparent. These rather striking characteristics found with considerable constancy in the few New England stations are far less apparent in the specimens seen from the more southern part of the range of the supposed typical variety. Numerous specimens from the mountainous regions of Georgia, Alabama, the Carolinas, Tennessee and Kentucky, as well as Deam's Indiana station, possess elongate, widely divergent branches with several to numerous nodes bearing narrowly linear to even filiform bracts. The extremes of leaf-type from the two ranges are often most striking and clear-cut but many specimens within the range attributed to one of the varieties would be assigned to the other upon the application of this criterion. These considerations have convinced me that it would be difficult to recognize varieties in this species in spite of some rather strong tendencies which are somewhat geographically segregated and whose extremes are of rather striking difference in aspect.

Gandoger based the description of *S. tracyi* upon the specimen in his herbarium of *Tracy 6468* collected at Biloxi, Mississippi. I have not seen his type but four specimens of the same collection number are located at the Gray Herbarium (2 sheets), New York Botanical Garden, and the National Herbarium. They are presumably isotypes. Gandoger described his specimen as an annual and this would relate or equate *S. tracyi* with *S. stellaris*, the only annual of subsection *Campanulatae* known to the state. The presumed isotypes, however, are perennials with narrowly oblong-linear to linear leaves gradually reduced above and on the branches to filiform bracts; their branches, which are alternate, are elongate, bear numerous nodes, and are very strongly divergent. There is still a trace of rose-pink color on the corolla-

lobes of at least three of the sheets seen although even on those sheets most of the flowers appear yellowish-white. Gandoger's species was described as having white flowers which together with the more slender leaves and mucronate sepals supposedly distinguished it from *S. gracilis*. *S. tracyi* is synonymous with *S. campanulata*, or, if one prefers to recognize what now seems to me to be a variation too weak to maintain, to *S. campanulata* var. *gracilis* (Michx.) Fern. It may be matched by a majority of the specimens collected along the Gulf and Southern Atlantic Coastal Plain.

REPRESENTATIVE SPECIMENS:—MASSACHUSETTS: Barnstable Co., Barnstable, *Fernald & Svenson*, PL. EX. GRAYANAE 479 (in many herbaria); Nantucket Co., Almanac Pond, *Williams*, 30 July 1911 (GH); Plymouth Co., Pembroke, *Foster*, 10 Sept. 1884 (GH). NEW YORK: Nassau Co., East Rockaway, *Bicknell* 7089 (NY); Suffolk Co., Oakdale, *Ferguson* 7775 (NY). NEW JERSEY: Ocean Co., e. of Silverton, *Fogg* 4908 (GH, NY, PENN, TENN). PENNSYLVANIA: Bucks Co., Tullytown, *MacElwee*, 28 July 1894 (GH, NY). DELAWARE: Kent Co., Felton, *Canby*, July 1878 (US). MARYLAND: County unknown, Delaware Beach, *Hood* 2370 (FLAS). DISTRICT OF COLUMBIA: Virginia Highlands, *Griggs*, 17 July 1923 (US). VIRGINIA: Greensville Co., ne. of Gaskins, *Fernald & Long* 13421 (GH, MO, TENN, US); Sussex Co., about 4 mi. nw. of Homesville, *Fernald & Long* 6351 (GH, NY, PENN). NORTH CAROLINA: Columbus Co., 2 mi. w. of Freeman, *Wilbur* 2882 (MICH); Henderson Co., 1 mi. s. of East Flat Rock, *Oosting* 1790 (DUKE); Northampton Co., near Margarettsville, *Heller* 1160 (CU, F, GH, KSC, MO, MT, NY, PENN, US). SOUTH CAROLINA: Anderson Co., Belton, *Smith*, 23 July 1881 (GH, US); Georgetown Co., 12 mi. n. of Georgetown, *Godfrey & Tryon* 66 (DUKE, F, GH, MICH, NY, PENN, TENN, US). GEORGIA: Bartow Co., 4.5 mi. s. 16° east of Allatoona Dam, *Duncan* 8521 (FLAS, GA, MO, SMU, TENN, US); Thomas Co., about 1 mi. n. of Coolidge, *Duncan* 8466 (FLAS, GA, MO, TENN). FLORIDA: Bradford Co., near Lawtey, *Murrill* 528 (DUKE, MO, US); Holmes Co., Bonifay, *Curtiss* 6481 (GH, MO, NY, SMU, US); Washington Co., 8 mi. s. of Chipley, *Webster & Wilbur* 3615 (MICH). INDIANA: Daviess Co., about 4 mi. n. of Washington, *Deam* 52742 (F, GH, MO, NY); Jasper Co., about 3 mi. se. of Wheatfield, *EK*, 30 July 1940 (GH). KENTUCKY: Fayette Co., Lexington, *Short*, 1831 (NY); Whitley Co., n. Jellico, *Braun*, 21 July 1933 (GH, NY). TENNESSEE: Coffee Co., n. of Manchester, *Svenson* 9219 (DUKE, GH, MO, NA, NY, WIS, US); Franklin Co., near Tullahoma, *Sharp, Clebsch & Fairchild* 9938 (DUKE, GA, NCU, OKLA, SMU, TENN, TEX, US). ALABAMA: Conecuh Co., about 9 mi. w. of Evergreen, *Webster & Wilbur* 3514 (MICH); DeKalb Co., Lookout Mountain, *Biltmore Herb.* 4510g (US); Mobile Co., about 8 mi. sw. of Mobile, *Webster & Wilbur* 3480 (MICH). MISSISSIPPI: Covington Co., 1.5 mi. se. of Mt. Olive, *Webster & Wilbur* 3336 (MICH); Forest Co., 18 mi. nw. of Beaumont, *Webster & Wilbur* 3424 (MICH); Jackson Co., Ocean Springs, *Pollard* 1010 (CU, F, GH, MO, NY, US). ARKANSAS: Lonoke Co., Grand Prairie, *Demaree* 22329 (MO); Pulaski Co., Little Rock, *Harvey*, July 1882 (UARK). LOUISIANA: Calcasieu Parish, Lake Charles, *Cocks*, Sept. 1906 (NO); Tangipahoa Parish, 3 mi. e. of Robert, *Correll* 9307 (DUKE, MO, TEX).

9. *Sabatia stellaris* Pursh, Fl. Am. Sept. 1: 137. 1814. *Chironia amoena* Raf., Med. Repos. II. 5: 359. 1808. not Salisb., Prodr. 137. 1796. *C. stellata* Muhl., Cat. Pl. Am. Sept. ed. 2, 23. 1818. *C. stellaris* [Pursh] Eaton, Man. ed. 2, 204. 1818. *Sabbatia maritima* Raf., Med. Fl. 2: 77. 1830. *S. amoena* (Raf.) G. Don, Gen. Hist. 4: 207. 1838. *S. stellaris* β *pumila* A. Gray ex Griseb., Prodr. 9: 49. 1845. *Eustoma maculata* Benth., Pl. Hartw. 292. 1848. *Sabbatia gracilis* β *stellaris* [Pursh] Wood, Am. Bot. & Flor. 267. 1870, without basionym. *S. nana* Featherman, Rep. Bot. Surv. S. & Cent. La. 71. 1871. *S. maculata* (Benth.) Benth. ex A. Gray, Proc. Am. Acad. 22: 438. 1887. *S. Palmeri* A. Gray, Proc. Am. Acad. 22: 438. 1887. *S. stellaris* f. *albiflora* Britton, Bull. Torrey Club 17: 125. 1890. *S. simulata* Britton, Bull. N. Y. Bot. Gard. 3: 448. 1905. *S. Purpusii* Brandegee, Univ. Calif. Pub. Bot. 4: 275. 1912. *Sabatia amoena* f. *albiflora* (Britton) Fern., RHODORA 34: 26. 1932. *Sabbatia campanulata* var. *amoena* (Raf.) Monachino, Torreya 41: 99. 1941.

Erect annual (2-)15-50(-80) cm. high; stem 1-4 mm. in diameter, terete to strongly angled due to several somewhat irregularly disposed fine lines or ridges extending between nodes, pith parenchymatous in young living specimens but becoming hollow in older or dried specimens. Branches almost always alternate, very rarely one or so nodes with opposite branches, usually restricted to upper half or two-thirds of the stem but sometimes arising throughout the length and even from the base, typically strongly divergent, forming an angle of about 30-70(-85) degrees with the stem, few to numerous, slender, wiry, bearing few to numerous nodes. Root-system of several to numerous, usually slender, but occasionally thickened, fibrous roots 2-10 cm. long, 1-3 mm. in diameter or occasionally with one principal root and several laterals. Leaves ascendent, above often closely appressed to stem, succulent, thick, rubbery in texture, midvein conspicuous and elevated beneath, venation otherwise obscure; after drying leaves commonly darken, usually thinly membranous or occasionally the lowermost slightly rugose, the midvein alone usually prominent. Lower leaves broadly to narrowly elliptic, or even linear, rarely spatulate or obovate, acute to rarely obtuse, often apiculate, usually tapering to both ends, typically about 5-10 times as long as broad, (0.5-)1.5-3(-6) cm. long, (2-)3-8(-15) mm. wide. Upper leaves more narrowly elliptic to linear, the uppermost sometimes very narrowly so to even almost filiform, usually 7-15(-20) times as long as wide, 1-4 cm. long, (0.5-)1.5-3(-5) mm. wide, typically exceeding the diameter of the stem or at least equaling it. Internodes usually 1-2 times the length of the leaves. Flowers appearing solitary but usually arranged in very loose and reduced cymes and these sometimes aggregated in loose clusters. Pedicels slender, straight, ascendent to divergent, (1-)4-10(-15) cm. long, usually about 0.5 mm. in diameter. Calyx-tube turbinate, or occasionally even narrowly campanulate, usually rather gradually narrowing to the base, smooth or but very faintly nerved, thin, somewhat scarious, usually 1-2 times as long as broad, (1.5-)2-4(-6) mm.

long. Calyx-lobes narrowly linear to almost filiform, ascendent or more typically wide-spreading, (4-)6-15(-22) mm. long, typically less than 0.5 mm. but rarely as wide as 1 mm., usually 3-6 times as long as calyx-tube, in general considerably shorter than the corolla, rarely equaling or exceeding it, apparently slightly hyaline-scarious margined. Corolla-tube about 2-3 times as long as wide, usually exceeding calyx-tube by 1-3 mm., translucent but appearing greenish due to ovary, (3-)4-6(-8) mm. long. Corolla-lobes strongly spreading, elliptic, oblong, spatulate, or obovate, obtuse to somewhat acute, (0.5-)1-1.5(-2) cm. long, (2-)4-8(-10) mm. wide, rose, pink, or more rarely white, with a usually irregularly 3-lobed yellow area at the base often bordered by a distinct, bright or dark red line which in turn is sometimes bordered by a white area of variable width. Anthers linear, yellow, (2-)3-4(-5) mm. long; filaments pale yellow to greenish, (1.5-)2-3(-4) mm. long. Style 2-4 mm. long, usually about half the length of its branches; stigmatic lobes 3-8 mm. long. Capsule from almost globose to cylindrical, (4-)6-8(-14) mm. long, (3-)4-5(-6) mm. wide, usually 1.6-2 times as long as broad. TYPE LOCALITY: "in salt marshes: New York, New Jersey &c." DISTRIBUTION: Salt marshes and sandy (usually littoral) places from southern Massachusetts south along the coast and throughout much of Florida and west into Louisiana. Also known from the Bahamas, western Cuba and the central plateau of Mexico. Map 9.

Sabatia stellaris is the most variable species of the *Campanulatae* but within this wide range of diversity there appears to be no sharply differentiated population that might be more naturally treated as a subspecies or a variety. Rather, there is an almost imperceptible change and as a consequence specimens from the northern limits of the range are often strikingly different from those seen at the extreme southern portion of its distribution. Typically, plants collected in southern Florida will be taller, more profusely branched, often from near the base, and these branches will be much more elongate, wiry, and slender. The leaves, for the most part, will be narrowly linear and only the uppermost with indications of a more elliptical or spatulate nature. The northern material will be on the average smaller, less branched, and then the branching usually restricted to the upper portion of the stem; the branches usually short and bearing few nodes. Also the leaves in most cases will be linear only in the very upper portion of the stem and otherwise will often be broadly elliptical. The sum of these differences results in plants of very dissimilar appearance. However, examination of an ample series taken from throughout the range will convince

one, I believe, that these differences are not sufficient for the recognition of subspecific categories. Rather these differences should in part be attributed to the great diversity in environment encountered through the range of more than twenty degrees of latitude and especially the difference in the length of the growing season between the Massachusetts coast and the shores of the Caribbean.

After initially attempting (1903) to distinguish between *S. campanulata* and *S. stellaris*, Small abandoned the effort and thereafter applied the former name to specimens of both species in the Southeast. The confusion between the two species is understandable due to the often misleading distinguishing criteria published in most works previous to the detection of the strikingly obvious differences by Bicknell (Bull. Torrey Club 42: 30-32. 1915.) and especially by Fernald (RHODORA 18: 145-147. 1916.). Thereafter there should have been little difficulty in distinguishing the two. However, most of the southern material of *S. stellaris* has passed as *S. campanulata* or the larger-flowered specimens as *S. grandiflora* due to the influence of Small's work. *Sabatia campanulata* is not known in peninsular Florida or from the West Indies.

Gleason's treatment (1952) illustrates the confusion that still exists in this species-group. He ascribes a salt or brackish marsh habitat to both *S. campanulata* and *S. stellaris* and includes the West Indies in the range of the former species rather than that of the latter. Furthermore he states that *S. stellaris* "and *S. campanulata* constitute the local extremes of a variable population which may represent only one species or as many as four. Even in our range numerous intermediate forms occur and their assignment to a species depends on the general prominence of characters of which the proportion of the petals is probably the most reliable. In the southeastern part of our range and in the southeastern states both species pass into forms with lvs. all linear (*S. gracilis* (Michx.) Salisb.)." The true picture is by no means as confusing or as complex as Gleason suggests. *Sabatia stellaris* and *S. campanulata* are separable by strong morphological features and the two species occupy mutually exclusive habitats.

It should be pointed out that while *S. stellaris* is rather closely confined to the littoral region in the northern part of its range,

specimens from inland peninsular Florida are fairly numerous. In spite of the information available in the literature, *S. stellaris*, at least in the southern part of its range, is not restricted to a salt-marsh or littoral environment and in fact is at least more commonly collected in inland sandy areas.

Britton (Bull. N. Y. Bot. Gard. **3**: 448. 1905.) and later Britton & Millspaugh (1920) recognized two species as occurring in the Bahamas, *S. campanulata* and the supposedly endemic *S. simulata*. This latter species was to be distinguished from what has been called *S. campanulata* by its more slender habit and smaller white flowers. All the material seen from the Bahamas has proven to be annual and consequently the larger-flowered plant with the rose-pink corollas is definitely not *S. campanulata*; it is *S. stellaris*. There is no break in flower-size between the pink and white flowered specimens although the latter are on the average smaller. Several of the larger-flowered specimens (2.5 cm. or more in diameter) had been designated by Britton as *S. simulata* apparently on the basis of the flower color. The stigma of *S. simulata* was described as "spatulate" in contrast to the "oblong-linear" stigma of "*S. campanulata*." I was unable to discover any consistent difference between the stigmas of the specimens. There was the usual variation dependent upon age. *S. simulata* is, I believe, merely a white-flowered form of *S. stellaris* and is conspecific with the pink-flowered specimens of the Bahamas. These color-phases are indistinguishable from much of the material from southern Florida and, for the present at least, all had best be treated as but another trend in the variation apparent in this species throughout its extensive range.

One name deserving brief discussion is *S. nana* of Featherman, which is not listed in "Index Kewensis." The description is here quoted in full:

Sabbatia Nana.—Stem simple, low, somewhat angled. Leaves small, sessile, the lower spatulate lanceolate, the upper linear lanceolate. Lobes of the corolla five to six, one third longer than the narrow linear calyx lobes. Root perpendicular, slender. Flowers rose-colored. Stem three to four inches high. Blooms in August.

Habitat—Marshy soil of Grande Isle.

The diagnosis is certainly brief but the shape of the leaves, the "narrow linear" calyx-lobes two-thirds as long as the corolla, the habit and the habitat all together make it quite certain

that *S. stellaris* was the plant being described. This Louisianan record is at or near the westernmost extremity of the species' present known range in the southeastern states.

Type-specimens of *S. maculata*, *S. palmeri*, and *S. purpusii* have all been examined and compared both with the few additional Mexican collections of the genus that have been made and specimens of the widespread species of eastern North America. Two of the species seemed very different from each other and at first I thought that I could easily distinguish them both from any others in the genus. *Sabatia palmeri*, on the other hand, very quickly seemed to be indistinguishable from *S. maculata*. After examining more material, especially from Florida, it became obvious that any of the Mexican specimens could be matched or very nearly matched by a considerable number of plants of *S. stellaris*. I am certain that I could not distinguish a large unlabeled series of specimens made in Florida and another large series made in Mexico. Therefore, all three names are here treated as synonyms of *S. stellaris*, a wide-ranging, variable species.

The blackened patches at the base of the corolla-lobes of the type of *S. maculata* are very striking and the epithet chosen by Bentham points out this feature. However, the dark black color can almost certainly be attributed to discoloration upon drying and has been noted in many specimens found as far north as New Jersey. The type itself seems indistinguishable from many specimens from Florida of which *Cuthbert 1525* (FLAS) from Manatee Co. is a good example. The type of *S. palmeri* is very similar in appearance to that of *S. maculata*.

S. purpusii is indistinguishable from many of the wiry Floridian specimens. For example, Pennell's collection (18048) from the state of San Luis Potosi seems remarkably similar to the collection of Hood 3565 (FLAS) among others from western peninsular Florida. In the Mexican specimens a tendency was noted for the calyx-tube to be more cylindrical with sides more parallel rather than strongly tapering and whose length is typically in the upper range of that of the specimens from the eastern United States. Also, the few capsules seen in the Mexican specimens of the *purpusii*-aspect appeared to be more slender and longer than those of most of the specimens seen from the principal area of distribution of the species.

The disjunct distribution of this species is somewhat perplexing. Fernald (RHODORA 18: 146. 1916.) stated that the range of *S. stellaris* was from "Massachusetts to eastern Mexico" and at that time he considered the plants called by some *S. purpusii* as part of the wide ranging species as is shown by his annotation labels. In the most recent edition of Gray's Manual the western limit of the range was stated to be Louisiana. The apparent absence of this species from the Texas coast and its eventual reappearance in eastern Mexico far south of the border and, most surprisingly of all, in the central plateau of that country is not easily explained. It was with considerable reluctance that attempts to distinguish these species were abandoned but there seemed to be no alternative. The absence of the plant from Texas is in particular inexplicable as there seem to be enormous stretches of territory offering an environment apparently similar to that in which it is found so abundantly in the Atlantic and Gulf Coastal Plain.

REPRESENTATIVE SPECIMENS:—MASSACHUSETTS: Bristol Co., Dartmouth, *Hervey* (GH); Dukes Co., Tisbury, *Cushman*, July 1911 (WIS). RHODE ISLAND: Washington Co., Westerly, *Weatherby* 3311 (NCS). CONNECTICUT: Fairfield Co., Stratford, *Eames*, 16 Aug. 1895 (NCU, NY, US). NEW YORK: Kings Co., Barren Island, *Svenson* 8242 (GA, GH, MO, PENN, TENN); Richmond Co., vicinity of New Dorp, *Small*, 2 Aug. 1890 (F, GH, MO, NA, NY, US, YU); Suffolk Co., mouth of Wading River, *Muenschler & Curtis* 6420 (CU, GH, MT, NY, US). NEW JERSEY: Cape May Co., Cold Spring, *Pennell* 2179 (GH, MO, US); Salem Co., about 4 mi. s. of Canton, *Fogg* 6054 (GH, PENN, TENN). DELAWARE: Sussex Co., 2 mi. s. of Rehoboth, *Larsen* 989 (GA, PENN, US). MARYLAND: Caroline Co., between Choptank River and Bethlehem, *Killip* 7278 (GH, US). VIRGINIA: Princess Anne Co., along Back Bay, *Fernald & Long* 11113 (DUKE, GH, MO, NY, US); Surry Co., Hog Island, *Fernald & Long* 12774 (GA, GH, MO, US). NORTH CAROLINA: Brunswick Co., near Southport, *Biltmore Herb.* 3304a (GH, MO, NCU, NY, US); New Hanover Co., Fort Fisher, *Godfrey* 4726 (DUKE, GH, NCU, NY, US). SOUTH CAROLINA: Georgetown Co., Pawleys Island, *Godfrey & Tryon* 306 (DUKE, F, GH, MO, NY, PENN, TENN, US); Horry Co., about 2 mi. sw. of Ocean Drive, *Wilbur* 2901 (MICH). GEORGIA: Chatham Co., Tybee Island, *Harper* 924 (GH, MO, NY, US); Glynn Co., Sea Island, *Cronquist* 5356 (FLAS, GA, GH, NO, SMU, US). FLORIDA: Brevard Co., Titusville, *Nash* 2303 (F, FLAS, GH, K, MICH, MO, US); Lee Co., vicinity of Fort Myer, *Standley* 12 (F, GH, MO, NY, US); Levy Co., 1 mi. se. of Chiefland, *Webster & Wilbur* 3639 (MICH); Monroe Co., Big Pine Key, *Small* 8148 (DUKE, GH, NCU, NY, PENN, WVA); Orange Co., about 2 mi. e. of Fort Christmas, *Moldenke* 210 (DUKE, MO, NY, PENN, US); Sarasota Co., Longboat Key, *Tracy* 6808 (F, MO, NY, US). ALABAMA: Mobile Co., saline marshes, *Mohr*, Aug. 1892 (NY). MISSISSIPPI: Harrison Co., Cat Island, *Tracy, Earle & Seymour* 101 (CU, GH, MO, NCU, WIS). LOUISIANA: Plaquemines Parish, Breton Island, *Tracy & Lloyd* 343 (CU, F, GH, MO, NY, US). BAHAMA ISLANDS: Abaco Is., *Brace* 1793 (NY); Andros Is., *Brace* 7116 (F, NY, US); Cat Is., *Britton & Millspaugh* 5780

(F, NY); East Bimini, *Howard 10274* (SMU, US); Eleuthera Is., *Britton 6427* (F, GH, NY, US); Great Bahama Is., *Brace 3518* (F, NY, US); New Providence Is., *Britton 58* [TYPE of *S. simulata* Britt.] (NY); *Curtiss 200* (F, GH, MO, NY, US). CUBA: Without more exact locality but very likely from Pinar del Rio, *Wright 412* [sheets sometimes mixed with *S. grandiflora*] (BRU, GH, NY, US). This is the same number but from a different collecting trip as the type of *S. gracilis* var. *cubensis* Griseb. (= *S. calycina*). MEXICO: Coahuila: Cuatro Cienagas, *Marsh 2068* (F). Michoacán: 60-70 mi. e. of Lake Pátzcuaro in bog 4 mi. w. of Hidalgo, *Hitchcock & Stanford 7196* (GH, UC). Jalisco: Lagos de Moreno, *Hartweg 1615* [TYPE of *Eustoma maculata* Benth.] (K); Rio Blanco, *Palmer 668* [TYPE of *S. palmeri* Gray] (GH). Querétaro: Querétaro, *Arsènen 10281* (US). San Luis Potosí: Media Luna near Rio Verde, *Palmer 80* (F, GH, MO, NY, UC, US) and *Palmer 80½* (GH, MO, NY, US); Minas de San Rafael, *Purpus 5345* [TYPE of *S. purpusii* Brandegees at UC] (F, GH, MO, NY, UC); Hacienda de Angostura, *Pringle 3810* (BRU, F, GH, MICH, MO, NY, UC, US); Las Tablas, *Pennell 18048* (US). Tamaulipas: Jaumave, *Rozynski 377* (F).

10. ***Sabatia grandiflora*** (A. Gray) Small, Fl. SE. U. S. 928. 1903. *Sabbatia gracilis* var. *grandiflora* A. Gray, Syn. Fl. N. Am. 2: 115. 1878. *Sabatia campanulata* var. *grandiflora* (A. Gray) Blake, RHODORA 17: 52. 1915. *Sabbatia Alainii* Marie-Victorin, Contr. Inst. Bot. Univ. Montreal No. 63: 73. 1948.

Erect annual (15-)40-90(-110) cm. high; stem (1-)2-5(-7) mm. in diameter, terete, although in dried specimens with several fine lines running between the nodes. Branches, rarely absent, almost entirely restricted to the upper third or half of the stem and almost invariably alternate, typically strongly divergent, forming angles of about 50-70 degrees, stiffly geniculate, bearing but few nodes. Plant appearing virgate from elongate, rigid internodes. Root-system of several to numerous fibrous roots 3-8 cm. long, 1-3 mm. in diameter. Leaves erect, at least above closely appressed against the stem, succulent, drying thick, rigid, rugose-roughened, venation obscure in both living and dried material; the lower spatulate, elliptic, oblong-linear or even linear, obtuse to acute, (1-)2-4(-5) cm. long, (2-)4-7(-10) mm. wide, typically about 5-10 times longer than wide, usually several times exceeding the typically short, 0.5-3 cm. long internodes; gradually to abruptly reduced above to very narrowly linear or even filiform, the width noticeably less than the diameter of the stem, (1-)3-5(-12) cm. long, (0.5-)1-2(-3) mm. wide, generally 20-60 times as long as wide, hyaline or callose-apiculate. Internodes above typically greatly elongate, often 2-5 times as long as the leaves. Inflorescence of (1-)2-3(-4) or rarely more flowers in reduced cymules; the flowers borne on slender, but rigid, elongate, terete pedicels (2-)4-8 (-12) cm. long and about 0.5 mm. in diameter; the flowers thus appearing solitary. Calyx-tube campanulate, usually broadly so, the sides more or less parallel, abruptly contracting to base or but gradually tapering in the lower half, typically 1-1.5(-2) times as long as broad, 2-4(-6) mm. long, generally very smooth or but very finely lined, the wall thin and somewhat hyaline-scarious especially with age. Calyx-lobes erect to spreading, very narrowly linear or filiform, (0.6-)1-2(-3) cm. long, usually



Maps 9–12. Map 9, upper left; map 10, upper right; map 11, lower left; map 12, lower right.

about 3–6 times as long as the tube, typically less than three-fourths as long as the corolla, rarely equaling or exceeding it, the tip callose-apiculate. Corolla-tube cylindrical, (3–)5–7(–8) mm. long, exceeding calyx-tube by about 2–4 mm., usually 1.5–2 times as long as wide, apparently colorless. Corolla-lobes strongly spreading, oblanceolate, obovate, broadly spatulate, oblong, or elliptic, usually obtuse or more rarely acute, (1.3–)1.8–2.5(–3) cm. long, (5–)7–12(–15) mm. wide, deep rose to pale-pink or white, with oblong basal yellow area 2–4 mm. long, rather irregularly lobed or toothed, and in the roseate forms usually bordered by an intense red line or area. Anthers linear, dark yellow, (3–)5–7(–8) mm. long; filaments yellow, slender, 2–4 mm. long. Style 2–5 mm. long; stigmatic lobes (4–)6–8(–9) mm. long. Capsule usually narrowly cylindrical, (6–)8–10(–15) mm. long, 4–5(–7) mm. wide, generally 2–3 times as long as broad. TYPE LOCALITY: "Coast of E. Florida." Lectotype: *Palmer 430* (GH!) from "Indian River." DISTRIBUTION: Everglades, pinelands and sandy places in peninsular Florida and western Cuba. Map 10.

In spite of the numerous striking characters which distinguish this species from any other, too much reliance has been placed

upon floral size as the criterion for the recognition of *S. grandiflora*. As a consequence one finds under this name in most herbaria a miscellaneous assemblage of large-flowered specimens belonging to subsection *Campanulatae*. Small never pointed out the distinctive characteristics of *S. grandiflora* and a considerable number of the specimens labeled or annotated by him are merely large-flowered *S. stellaris*. The identity of these incorrectly determined specimens is shown by the smooth, thin texture of the dried leaves which above, although narrowly linear, are typically as broad or broader than the diameter of the stem. Also these large-flowered specimens of *S. stellaris*, which have been so often mistaken for *S. grandiflora*, are generally more profusely branched, especially below the middle of the stem. *S. grandiflora* may be readily distinguished from *S. stellaris* by its thick rugose-roughened or wrinkled leaves which above are almost filiform and less in width than the diameter of the stem. Furthermore, it is typically a larger and coarser plant with branching more or less restricted to the upper third or half of the stem. Another fairly reliable feature that may be utilized in recognizing *S. grandiflora* is that its calyx-tube is most often broadly campanulate, while that of *S. stellaris* is more typically narrowly turbinate. That much-relied-upon character, the length of the corolla-lobes, is at best a subsidiary one because of the considerable overlap in the size of flowers between the two species.

In spite of the inferences that might be derived from the synonymy, the relationship of *S. grandiflora* is closer to *S. stellaris* than to *S. campanulata* (= *S. gracilis*). Numerous differences might be listed to distinguish *S. grandiflora* from *S. campanulata* with which it was originally and even later considered to be a variety. However, the most obvious and perhaps most fundamental is that the latter is a caespitose perennial while *S. grandiflora*, like *S. stellaris*, is an annual. The perennial species is not known in peninsular Florida. *S. stellaris* has been collected throughout the state, while in Florida, *S. grandiflora* is almost entirely restricted to the peninsular portion. Judging from the number of mixed sheets of *S. stellaris* and *S. grandiflora*, there is considerable overlap in range of habitat between these two species if their environmental tolerances in Florida are not exactly the same.

In the United States other than in Florida, *S. grandiflora* is represented only from Louisiana by a specimen attributed to Josiah Hale deposited in the Gray Herbarium. This collection is *S. grandiflora* but more recent collections from Louisiana seen in the herbaria under this name have always proven to be large-flowered specimens of *S. stellaris*. Confusion in labeling should be considered a strong possibility for this specimen reputedly from Louisiana.

After the short original diagnosis, Gray presented the collections known to him in the following manner: "coast of E. Florida, Leavenworth, Buckley, Palmer & c.". Theirs are the only specimens available to him now preserved in either the Gray Herbarium or that of the New York Botanical Garden; who the other collectors were is unknown to me. Palmer's collection, made in 1874, is definite and all four sheets at the three different herbaria bear the information "Indian River, East Florida" as well as the number "430." These specimens are also equal to or better than the others and, in spite of being collected after a varietal status had been decided upon (with another epithet) based on the other collections, Palmer's collection (no. 430) at the Gray Herbarium is here designated the lectotype.

The recently proposed *S. alainii* from Cuba here is considered to be but a synonym of *S. grandiflora*; its distinctness has certainly not as yet been demonstrated. The original description of this supposedly distinct Cuban entity was accompanied by the following discussion in reference to its relationship with *S. grandiflora*. "Cette espèce se rapproche du *Sabbatia grandiflora* par sa grande corolle, ses curtes feuilles, l'absence d'oeil jaune, sa capsule plus petite." The meaning of this is not altogether clear. It would seem as though a word or so had been omitted in printing and that the first two characters mentioned were meant as features shared in common by *S. grandiflora* and the newly proposed species and that the second two phrases were supposed distinctions. The stated absence of the yellow eye in the throat of the corolla-tube and at the base of the lobes of *S. alainii* is not borne out by examination of either the type material, distributed isotypes or information ("white with light yellow eye") provided on the label of Britton *et al.* 7166 which was collected in the same region. The few

capsules available were smaller but did not appear to have fully developed. The Cuban representatives of this group are, I believe, indistinguishable from those of Florida.

REPRESENTATIVE SPECIMENS:—FLORIDA: Alachua Co., Earleton Beach, *Loucks*, 5 Sept. 1927 (FLAS); Brevard Co., between Cocoa and Lake Poinsett, *Rhoads*, 23 May 1937 (FLAS); Broward Co., Ft. Lauderdale, *Small & Wilson 1785* (NY); Charlotte Co., without exact locality, *Frye*, 17 May 1946 (FLAS); Clay Co., Keystone Heights, *West*, 29 June 1930 (FLAS); Collier Co., 2 mi. s. of Immokalee, *Sheehan* 28 Feb. 1919 (NY); Dade Co., w. of Camp Jackson, *Small & Wilson 1991* (NY); DeSoto Co., Lacy, *West*, 23 Sept. 1938 (FLAS); Duval Co., without exact locality, *Fredholm 5* (GH); Glades Co., Lakeport, *Lovett 264* (DUKE); Hardee Co., Limestone, *Kirk*, 1 July 1942 (FLAS); Hendry Co., se. corner of county, *Davis*, 13 Sept. 1947 (FLAS); Hernando Co., without exact locality, *Hitchcock 1283* (F, MO); Highlands Co., near Brighton, *McFarlin 10913* (GH, PENN); Hillsborough Co., Tampa, *Garber*, May 1876 (BRU, F, NY, US, YU); Indian River Co., near Felsmere, *Small 8917* (NY); Lake Co., Eustis, *Nash 763* (CU, F, GH, MICH, MO, NY, US); Lee Co., about 8 mi. se. of Fort Myers, *Standley 446* (F, GH, MO, MT, US); Levy Co., Bronson, *Watson & Murrill*, 18 June 1939 (FLAS); Manatee Co., near Palma Sola Bay, *Cuthbert*, 23 June 1916 (FLAS); Marion Co., Lake Kerr, *West & Arnold*, 21 July 1935 (FLAS); Martin Co., Stuart, *Atwood 1917* (CU); Okeechobee Co., n. of Fort Drum, *West*, 22 Apr. 1946 (FLAS); Orange Co., near Oakland, *Curtiss 6624* (CU, GH, MO, NY, US); Osceola Co., Kissimmee, *Singleton 136* (DUKE, NCU); Palm Beach Co., along the Palm Beach Canal, *Small 8280* (FLAS, NY, TENN); Pasco Co., near Zephyrhills, *Hood 3483* (FLAS); Pinellas Co., near St. Petersburg, *Deam 1901* (MICH); Polk Co., n. of Davenport, *Hood 3546* (FLAS); Putnam Co., Welaka, *DeVall*, 23 June 1939 (FLAS); Sarasota Co., Myakka River State Park about 18 mi. se. of Sarasota, *Wilbur & Webster 2502* (MICH); Volusia Co., near Ariel, *Moldenke 180a* (NY, PENN); County unknown, Indian River, *Palmer 430* [LECTOTYPE of *S. gracilis* var. *grandiflora*] (F, GH, NY). CUBA:—Pinar Del Rio: au bord des lagunes de Santa Maria, San Luis, *Marie-Victorin & Alain 369* [TYPE of *S. Alainii*] (GH, MT); Borders of Laguna Santa Maria, *Britton & Gager 7166* (NY, US). Province not stated, *Wright 412* [sheets sometimes mixed with *S. stellaris*] (BRU, NY, US).

11. *Sabatia brevifolia* Raf., Atl. Journ. 1: 147. 1832. *S. Elliottii* [Elliottii] Steud., Nom. Bot. Ed. 2: 489. 1841. *S. paniculata* β *Elliottii* [Steud.] Wood, Am. Bot. & Flor. 266. 1870, without basionym.

Erect annual (15-)30-60(-70) cm. high; stem (1-)2-3(-4) mm. in diameter, terete, but usually finely ridged or lined by slight elevations extending between the nodes, pith hollow, at least below. Branches typically alternate, always so above, but in robust, profusely branched plants occasionally with few to several branches of the main stem and even near base of principal branches opposite; in large well-developed plants usually branching throughout the length of the stem, in smaller plants often restricted to the upper half of the stem, strongly ascendent to more commonly widely divergent, usually forming an angle with the stem of (20-)40-60(-80) degrees, slender, very wiry, usually bearing numerous nodes, the internodes not elongate; the aspect of the plant strikingly wiry-virgate. Root-system a pronounced slender or occasionally thick-

ened tap-root 2-8 cm. long, (1-)2-3(-4.5) mm. in diameter, bearing few to several very slender laterals. Leaves ascendent and apparently appressed on the main stem and the more or less vertical branches but on strongly divergent branches usually strikingly upwardly secund and often appearing falcate, midvein alone easily detected and that elevated beneath, apex very minutely apiculate, the lowermost somewhat obovate, oblanceolate, oblong, elliptic, or linear, (0.5-)1-2(-3) cm. long, (1-)2-5(-7) mm. wide, typically obtuse or sometimes acute, usually tapering to the sessile base, generally 3-6 times as long as wide; those from about the middle of the stem narrowly oblong or more commonly linear, 1.5-2.5 cm. long, 1-3 mm. wide, acute; the upper cauline leaves and those of the branches narrowly linear to filiform or even subulate, gradually reduced to about 3-5 mm. long and less than 0.5 mm. wide, and almost invariably less than 2 mm. wide or twice the diameter of the stem but often the same width, usually 10-25 times as long as broad. Internodes usually 1-2 times the length of the leaves, occasionally greater or sometimes, especially near the base, less. Flowers appearing solitary but arranged in reduced often 1-2-flowered usually secund cymes on the upper side of the divaricate branches. Pedicels very slender, wiry, erect (1-)2-4(-5) cm. long. Calyx-tube turbinate, sides sloping to the base, smooth or more commonly noticeably finely nerved, internodal wall thin, often scarious, about 1-2 times as long as broad, (1-)1.5-2.5(-3) mm. long. Calyx-lobes setaceous or subulate, ascendent to wide spreading, (3-)4-7(-8) mm. long, tapering from about 0.5-1 mm. base, usually 2-4 times as long as the calyx-tube, usually not exceeding half the length of the corolla. Upper half of corolla-tube usually cylindrical, tapering below middle to the base, about 1.5-2 times as long as wide, usually 1-2 mm. longer than the calyx-tube or about 2 times as long, (2.5-)3.5-4.5(-5) mm. long. Corolla-lobes spreading, elliptic, oblong, oblanceolate, or broadly spatulate, (0.6-)0.9-1.3(-1.8) cm. long, (2-)3-5(-7) mm. wide, usually obtuse but not uncommonly somewhat acute, white with a greenish-yellow to yellow patch at base of lobe. Anthers linear, yellow, (2-)3-5(-6) mm. long; filaments greenish-yellow to pale yellow, 1-2 mm. long. Style 1 mm. long or less; stigmatic lobes 3-5 mm. long. Capsule cylindrical, 3-6 mm. long, 2-4 mm. wide. TYPE LOCALITY: Florida. Type: unknown. Described by Rafinesque along with thirty other species from Florida "seen in gardens and herbals." DISTRIBUTION: Pinelands and savannas from southeastern South Carolina along the Coastal Plain throughout most of Florida and west at least to Alabama. Map 11.

This species was described originally by Elliott with the acknowledged aid of Baldwin but the name applied to it was *Sabbatia paniculata*. This erroneous nomenclature was generally employed even after it was understood to be a mistake. Chapman (1860) was persuaded by Gray to take up the substitute name first proposed by Steudel nearly twenty years

before. Elliott's application of Michaux's epithet which initiated the confusion is curious in view of his understanding of the subject as shown by the following quotation:

Though the description of Michaux applies more peculiarly to the *S. corymbosa*, yet as this species was certainly included, and is the only one to which the term *paniculata* is certainly applicable, I have referred to him here.

This change in concept of the species passing as *S. paniculata* was pointed out by Grisebach (1839) but he chose to continue the use of the name in the sense of Elliott. Steudel simply substituted the epithet *elliottii* (as *Elliottii*) citing in synonymy "*S. paniculata* Ell. (non Pursh)." The original spelling of the name need not be retained in a case such as this as it was clearly an unintentional orthographic error. Steudel, in listing Stephen Elliott's name, spelled the name, "Elliot." It seems hardly possible that anyone would carry the prerogative of modifying a name when latinizing it to a bibliographic listing; the change must have been unintentional. Wood's solution to the confusion that had enveloped the nomenclature of the white-flowered *sabatias* was to reduce *S. elliottii* to varietal status of *S. paniculata*. This indicated no more than a vague bibliographic rather than biological familiarity with the plants.

Nine years before Steudel's publication of *S. elliottii*, Rafinesque in a paper describing over thirty species from Florida belonging to various genera "seen in gardens and herbals" published *S. brevifolia*, the original description of which is here quoted in full:

8. *Sabbatia brevifolia* Raf. Stem dichotomus filiform leaves short subulate acute, flowers terminal white, calyx shorter than corolla setaceous, segments of corolla obovate. Near to *S. brachiata* and *stellaris*.

This description, although very brief, seems very apt in pointing out the stronger features that characterize the species that has long been called *S. elliottii*. Even in the absence of an authentic specimen I feel no hesitation in taking up Rafinesque's name other than that caused by the regret of seeing a well-established name replaced by one long-forgotten. It would be difficult to present a better description in so few words of the plant first characterized by Elliott than Rafinesque's attempt. Every descriptive phrase fits Elliott's plant very well.

REPRESENTATIVE SPECIMENS:—NORTH CAROLINA: without locality, *Delile* (NY). Since this species is not otherwise known north of Charlestown, S. C.,

its presence in North Carolina seems most doubtful. SOUTH CAROLINA: Beaufort Co., Bluffton, *Mellichamp*, 1886 (F, MO, NY, US); Charleston Co., Adams Run, *Godfrey & Tryon* 1544 (DUKE, F, GH, MICH, MO, NY, PENN, TENN, US); Hampton Co., about 4 mi. se. of Hampton, *Wilbur & Webster* 2825 (MICH); Jasper Co., Ridgeland, *Mohr*, Nov. 1893 (MO, NY, US). GEORGIA: Camden Co., w. of St. Marys, *Small, DeWinkeler & Small* 10545 (DUKE, WVA); Charlton Co., Okefenokee Swamp between Chesser Island and Camp Cornelia, *Thorne & Ford* 2064 (CU, GA); Coffee Co., without exact locality, *Harper* 681 (NY, US); Pierce Co., 3 mi. n. of Blackshear, *Thorne & Norris* 6202 (CU, GA); Ware Co., 5 mi. se. of Waycross, *Wilbur & Webster* 2731 (MICH). FLORIDA: Brevard Co., Merritts Island, *Curtiss* 2227 (F, GH, MO, NY, US); Clay Co., about 2 mi. n. of Orange Park, *Moldenke* 162 (DUKE, MO, NY, PENN, US); DeSoto Co., 4 mi. w. of Arcadia, *Webster* 4224 (MICH); Duval Co., near Jacksonville, *Curtiss* 5114 (CU, F, GH, NCS, NY, US); Franklin Co., Apalachicola, *Biltmore Distrib. Chapman Herb.* 903b (GH, MO, NCS, NCU, NY, PENN, US); Hernando Co., between Brookside and Bayport, *Jones* 43 (CU, US); Hillsborough Co., Tampa, *Nash* 2422 (F, GH, MICH, MO, MT, NY, US); Indian River Co., near Felsmere, *Small* 8902 (FLAS, GH, NY, US); Jackson Co., 4 mi. e. of Marianna, *Wiegand & Manning* 2559 (CU, GH); Lake Co., near Cassia, *Hood*, 1 Sept. 1911 (FLAS, GH); Lee Co., s. of Fort Myers, *Moldenke* 909 (DUKE, MO, NY, PENN, US); Liberty Co., near Roy, *Wiegand & Manning* 2558 (CU, GH); Manatee Co., Bradenton, *Tracy* 7080 (CU, F, FLAS, GH, NY, PENN, TAES, US); Orange Co., about 2.5 mi. ne. of Apopka, *Wilbur & Webster* 2650 (MICH); Palm Beach Co., Earman, *Randolph* 26 (CU, GH); Pinellas Co., about 4 mi. w. of St. Petersburg, *Deam* 2840 (MICH, US); Putnam Co., 10 mi. se. of Interlochen, *Fox* 5700 (MICH, NCS); Seminole Co., Lake Monroe, *Garber*, Mar. 1896 (BRU, F, US, YU); Volusia Co., Beresford, *Hood*, 21 Sept. 1910 (FLAS, MO). ALABAMA: Mobile Co., between Theodore and Hollander's Island, *Pennell* 4512 (NY, PENN). LOUISIANA: without locality data, *Featherman* (no). This species should not be included in the flora of the state without a better substantiated record. It seems likely that there is confusion in labeling in regard to this collection.

(to be concluded)

EPIFAGUS VIRGINIANA.—On the northern exposure of a deciduous woods, consisting chiefly of oaks and beeches, there is at Swarthmore, Delaware County, Pa., a large colony of *Epifagus* which is butter-yellow in color. Nearby a number of hemlocks are growing, but this plant is not found under these, but confines itself to the deciduous trees. A year ago I counted 300 of this yellow *Epifagus* without materially changing my position, and this year ('54) I counted 175 plants along a wood's lane within the space of 100 feet. A fair estimate of the plants on this northern hillside would be more than 1000.

The plant resembles the species closely except for color. If any difference is to be noted I think the yellow form tends to be more bushy and is perhaps more fleshy. However, there

are numbers of single-stemmed plants scattered about. Some of these are pure yellow, but others show touches of reddish brown on the stem scales.

The usual color-form of *E. virginiana* does not appear within the area occupied by the main growth of the yellows, but as the yellows diminish along the edges the usual form appears. The whole area is about an acre in extent.

The concentration of the yellow forms on this hillside suggests a common origin for them, but does not explain the absence of the usual form. So many plants of this one color within the limited area indicated with the usual form of the species on the periphery offers a nice problem of distribution and might provide an interesting population study for the appropriate person.—
SAMUEL C. PALMER, SWARTHMORE, PA.

CALYCERA BALSAMITAEFOLIA IN THE UNITED STATES.—Recently there were found in the Herbarium of the Chicago Natural History Museum two sheets of *Calycera balsamitaefolia* (Juss.) Rich., of the family Calyceraceae. They were included in the J. T. Rothrock collection, when that herbarium was purchased by the Chicago Natural History Museum in 1909. Both sheets were collected on ballast at Kaighns Point (spelled Kaighns on the label) in New Jersey. This station is near Camden opposite Philadelphia. One sheet has the label of "Herbarium of Isaac Burk, Philadelphia; Pa.", the other sheet accompanied by a label of the "Herbarium of University of Pennsylvania." No date is indicated on either label.

It is of interest to note this collection, because the species is a native of Chile, and is not mentioned in either the eighth edition of Gray's Manual, Gleason's New Britton & Brown, or any of the floras of New Jersey and Pennsylvania. Probably collected at the station given above in the latter decades of the nineteenth century or at the beginning of the twentieth century, the species apparently has never been re-collected either at the Kaighns Point station or elsewhere. Botanists from the vicinity of Philadelphia and New York should give special attention to ballast sites similar to the one where *Calycera* was found.—
JULIAN A. STEYERMARK AND FLOYD A. SWINK, CHICAGO NATURAL HISTORY MUSEUM AND COLLEGE OF PHARMACY, UNIVERSITY OF ILLINOIS.

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